LOAD FORECASTING

Submission of

ONTARIO HYDRO

to the

Royal Commission

On Electric Power Planning

with respect to the

Public Information Hearings

May, 1976

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9.0 LOAD FORECASTING - INTRODUCTION

At the present time, Ontario Hydro's objective is to provide generation and transmission facilities which will supply the expected load at the lowest feasible cost subject to constraints of safety, reliability, environment, and financial integrity.

The planning process begins with the load forecast. At least once each year, a complete review is made of the load forecast for the following ten years. In the interval between the successive annual reviews, the progress of actual load growth and economic conditions is monitored and, if necessary, revised forecasts are issued to reflect conditions different from those contemplated when the last complete annual review was made.

The risks introduced by error in the load forecast are twofold: inadequate capacity due to underestimating the load, or excess capacity due to overestimating the load. Inadequate capacity may result in an unreliable supply; and this may cause direct financial losses to power customers and increased social costs to the province. Excess capacity may lead to financial risks resulting from inadequate revenues to Ontario Hydro in the short term, and the direct financial loss to power customers due to unnecessarily high power costs in the long term.

It is worth noting that the costs of "excess" capacity are borne by Hydro (and passed on to customers), but the costs of inadequate capacity are borne entirely by customers in the form of economic loss and inconvenience. The solution to the problem of optimum capacity lies in balancing these two sets of costs - one of which is borne initially by the utility, while the others do not pass through its books. It is partly for lack of concern with the latter set of costs, and exclusive concern with the former that private monopolies tend to restrict output (unless they are subject to decreasing average costs).

The difficulty in optimizing the amount of capacity is that the costs of loss of load to customers are not known. It is possible that this could be represented in terms of loss of customer surplus if the demand function were known. The load forecast

effort is therefore preoccupied with reducing error to a minimum. In practice, this means that the forecast effort should try to avoid consistent error in either direction.

There are two dimensions to the load forecast. The first is the "most probable" load, which is defined as that load which has equal probabilities of being too high or too low; it is the expected or most likely load. The second is an estimate of the distribution of error associated with the forecast. The estimated error enables the system and financial planners to assess the risks to which any proposed plan is subject. The general plan which stands up best under a wide range of possible outcomes is the best plan, even though it might not stand up as well under the actual outcome of events as some other particular plan might have. The difference in cost between the general plan and the particular plan is an indication of the cost of uncertainty.

It is possible that a forecast may give rise to a general plan that is unattainable or unacceptable under existing constraints. Under such circumstances, it is necessary to obtain assurance that the level of the forecast is reasonable. This is a difficult exercise for the following reasons:

(a) The easiest way to solve the problem may seem to be to adjust the forecast so that the constrained plan is attainable and acceptable. For example, under present conditions, when the economy is slack and is strike-ridden, there is abundant evidence to suggest that the load forecast should be lowered. Yet the record shows that under similar circumstances in the past, when the forecast has been lowered, it has almost invariably been lowered too much. By the same token, in the past the forecast has been raised unduly when it was made under buoyant economic conditions.

(b) It is often argued that the future will not be like the past, and therefore, that forecasting by analogy with the past is invalid. However, this begs the question, because it is necessary to specify just how the future will differ from the past. This line of thought may lead to an implicit assumption that the future will be simply an extension of the present - which, as

noted above, has proven to be an apparently unavoidable temptation, often producing results which are less accurate than projecting the past.

(c) Exponential growth cannot be sustained indefinitely. Therefore, it is sometimes argued that any forecast which results in exponential growth, even for relatively short future periods, is too high. This type of argument prevailed in some forecasts made 20 years ago in other parts of the world, with unhappy results. No one knows whether it may be correct at present.

Any forecast that is decided upon at a time when the level of the forecast is a matter of a serious controversy may be subject to a greater error than might be the case in the absence of controversy. Whether or not such a forecast will lead to a change in the general plan of development may depend upon the degree to which the load forecast error affects the planning decision. For example, in the above case, the load forecast of most probable load may be lowered, but the load forecast error may be increased. However, the general plan of development may not change greatly, if the increase in load forecast error is fully taken into account.

In any case, where capacity constraints exist, it is important to have some idea of the possible amount of unsatisfied load, because this is a measure of the cost to power customers and to the economy against which the savings to the electric utility arising from reduced generation levels must be assessed.

The stability of successive load forecasts is also a matter of concern. Forecasts should be as accurate as possible, and if they were completely accurate, they would not change. Because they are not accurate, they do change from one year to the next, due to access to new information. However, frequent reversal in forecast levels for any one year are disruptive to the general plan for development. Therefore, a change in forecast levels should probably be made only if there is reasonable assurance that the direction of the change will not be reversed the next time around. Thus, stability in the forecast from one year to the next is a desirable attribute, although it is not a forecast procedure.

The advantages of stability may be out-weighed by the effects of change in conditions from one year to the next.

9.1 FORECASTING CONSIDERATIONS AND METHODS

9.1.1 General Remarks

In January 1974, the Ontario Energy Board examined Ontario Hydro's Load Forecast in considerable detail. The following description of the process of growth is taken largely from Volume 2 of Hydro's Submission to the Ontario Energy Board of December 19, 1973.(1) This description of the Load Forecasting process is also based on that submission, but has been rewritten in the light of the cross-examination by Counsel for the Ontario Energy Board. This evidence and that adduced in the 1975 hearings(2) brought out the vital part played by regional personnel in preparing the forecast, because they modify the results of the forecasting model in the light of intimate local knowledge. The other important aspect brought out in testimony was the fact that the load forecasting process, by virtue of its geographical detail, does not isolate the effects of global economic and social causes. These must be inferred from the results of the forecasting process, and if these results do not appear to be reasonable in the light of expectations about the economy, then the application of judgment is called for - either by way of modifying the forecast in the Load Forecasting Unit or by way of decisions which may be made concerning an adequate level of reserve capacity.

9.1.2 The Process of Growth

For the past 53 years, the East System Primary Peak Demand has grown at a fairly steady average rate of 6.8 per cent per annum, with annual rates varying from a minimum of -6.5 per cent in 1931 to a maximum of 15.2 per cent in 1939. Both years witnessed events that can be regarded as extreme - namely the onset of the Great Depression and the outbreak of World War II. Within the last seven years, annual growth has ranged from a high of 11.7 per cent in 1968 to a low of 0.4 per cent in 1974. These latter extremes reflect a growing sensitivity of peak demands to weather.

Fluctuations in the business cycle have been less severe since World War II. There seem to be two reasons for this growing stability in economic conditions, and they are reflected in load patterns. One reason is that industrial loads, related to the production of goods, have been growing somewhat less rapidly than other sectors of demand, and consequently the cyclically sensitive industrial demand is becoming a smaller portion of the total. The same is true of the economy in general. The second reason is that as the Ontario economy has become larger, it has become more diversified and consequently there has been an increased offsetting of short-term trends in one sector by those in another. This is true of the East System, but not of the West System which remains primarily a region specializing in staple resources (pulp and paper, gold, base metals and iron mining) which tend to be very sensitive to economic conditions. A variant of the second reason is to be found in the growing multiplicity of end-uses for electric energy in all sectors.

Weather fluctuations and economic fluctuations are quite different in their impact on the system. While both are random and unpredictable the duration of fluctuations due to weather is short; that of economic fluctuations is prolonged over a matter of years. In medium range forecasting (the next decade), appropriate to Ontario Hydro's generation lead time, it is therefore much easier to deal with weather fluctuations than it is to cope with the business cycle. For one thing it is relatively easy to define expected or normal weather conditions, and extremely difficult to do the same thing for economic conditions. Moreover, there are structural changes going on in society which profoundly affect the demand for electric energy over the long run - events such as sustained rates of immigration, birth rates, the urbanization of Ontario, the shift from single family dwelling units to apartments, and the growth of tertiary industry. More recently there has been a growing concern with environment and the quality of life. The impact of this concern upon the demand for electric energy gives rise to considerable uncertainty. A great deal of the concern has focussed on the production of electric energy, and the parallel concern with exponential growth has tended to focus upon growth in energy consumption in

general and electric energy consumption in particular as evils to be avoided.

At the same time, the importance attached to the quality of the individual's personal indoor environment has led to a growth in air conditioning and electric heating. Insofar as cleaning up the atmosphere and the Provincial waterways is concerned, some industries and municipalities can comply only by introducing electrically powered equipment for recycling and removing materials from their effluents. Since October, 1973, there has been growing concern with not only the price, but the availability of primary fuels, especially oil and gas. The result, on balance, seems more likely to portend an increase in the rate of growth of the demand for electric energy.

Electricity differs from most other forms of energy in that it is a product which is manufactured, and which can be made from almost any other type of energy. Consequently, it is able to draw upon more technical alternatives than any other energy source, and this may tend to make its price more stable over the longer run.

Generally speaking, the demand for electric energy has grown more rapidly in its mature phase than other types of energy. Electricity has therefore acquired an increasing share of the energy market in Ontario with the passage of time. In a very general way one can think of the growth in demand in these portions - that due to increasing population accounting for something slightly in excess of 2 per cent, with the 4.7 per cent per capita increase consisting of a "normal" increase in the order to 3 per cent and the balance representing a shift to electric energy from other types. The prospects for the future, seen from this perspective in time, call for a moderation in the rate of population growth (depending upon fertility rates, net migration to Ontario from other provinces and Canadian immigration policy). While subject to considerable uncertainty, the prospects for the shift seem to be further towards electricity depending upon relative prices and availability of other fuels, the availability of capital and the thrust of public environmental policy.

9.1.3 The Effects of Price and Personal Income

The effects of price and incomes upon the growth of demand for electric energy are extremely difficult to assess.

In the industrial sector, the technical coefficients (units of electrical energy input per unit of ouput) do not seem to be especially uniform between plants within an industry and of course they vary considerably between industries. The prospects are that using these coefficients will prove even less rewarding in the future than in the past, due to the amount of consumption of electricity that is related more to pollution abatement than to production.

The commercial sector which is growing most rapidly, has undergone considerable change in its nature of use of electricity, and there is uncertainty as to the future pattern of use.

Because residential consumption is relatively homogeneous (in comparison with industrial and commercial), it lends itself to a greater degree to statistical analysis. What has been observed is that residential consumption is very responsive to incomes. This shows up very clearly in a study of municipal residential consumption since World War II. This study shows a remarkable stability in the relationship: monthly energy consumption is approximately the amount that can be purchased with the earnings from three hours of work. During the period, appliance prices and rate structures have remained relatively stable, but incomes have risen substantially.

Much more difficult to estimate is the response of residential consumption to price. Part of the difficulty stems from the residential block rate which makes average price depend upon consumption. This makes it impossible to observe the effect of price upon consumption. In the absence of significant changes in the rate level, it is not possible to observe anything more than a series of points on different price-quantity relationships. However, in cases where there have been abrupt changes in rate level (such as Chapleau in 1965[3]), it is possible to estimate what consumption would have been in the absence of the rate change, and hence to estimate the effect of price upon

consumption. From this, crude estimates of price elasticity can be made.

Studies to date indicate that elasticity is also a function of time. A customer's consumption of electricity by use of the particular stock of appliances that he owns probably does not respond immediately to any change in the price of electricity. However, a customer may greatly increase his stock appliances and his use of electricity if there is a significant reduction in the price of electricity.

Whether the relationship would hold in the case of a price increase is open to doubt, since customers would probably have to suffer a loss in order to dispose of appliances. In some cases (e.g. rental water heaters) where competitive forces permit an easy substitution without the customer suffering a capital loss, the adjustment can be quite drastic and rapid. In other applications, such as electric heating, the consumer has less freedom of choice, but nevertheless the impact upon new business could be significant. In the long run, the relevant prices in each application are not only the price of electricity, but also the prices of alternative services.

This is an important area in which ignorance of the process persists. With the prospect of increases in all energy prices, but with variable timing of the impacts on different fuels, the medium term (next decade) uncertainly is quite large. As mentioned previously, the long term outlook for the relative price of electricity is that it may tend to become more attractive if only because of the larger number of technical options open in the process of its manufacture.

9.1.4 The Effects of Government Policy

The effect that government policy may have upon the magnitude of total growth in Ontario is not known; but it is expected that it may have a considerable impact upon the geographical distribution of that growth. This will depend upon the degree to which market forces are overcome or redirected by government policy. It appears that unfettered allocation of growth in Ontario by existing market processes may lead to a socially untenable

development. While there is almost complete agreement with this premise, there is no such unanimity on any particular alternative to it, and consequently the details must evolve through the political process. This complicates the forecasting problem in that political forces must be taken into account. It is necessary to forecast the outcome of the process which may prove to be quite different from the intent. This may pose problems in forecasting, and will require at least that some provision for uncertainty be made in these forecasts.

9.2 THE FORECASTING PROCESS

9.2.1 General Remarks

If one looks at a graph of Ontario Hydro's load growth in an attempt to answer the question "What will be the load tomorrow?", one is confronted with an almost infinite spectrum of possibilities varying from:

i) 10 times today's load

ii) zero

Neither of these alternatives is impossible, but neither is very probable. Loads of either double today's or one half of today's seem more probable. If one can imagine a probability attached to each possible load, then the inclination is to use that load with the highest probability as a forecast. The probabilities are affected by patterns in the load. If tomorrow is Saturday that makes a difference, because there is a regular and therefore predictable variation to loads on various days of the week. There are similar regular patterns associated with the time of day and time of year. Over a long period of years, there is also a discernible regular pattern of growth. The kind of weather tomorrow will affect tomorrow's load. If it is very cold, the load will be high due to heating, if it is dark, the load will be high due to lighting. So a weather forecast, together with some quantitative knowledge of the relationship between temperature, illumination and load would help produce a better forecast for tomorrow. However, a weather forecast for a year from tomorrow, or ten years from tomorrow is not available. Weather is a random variable,

unpredictable in the long run. Thus, in the absence of a weather forecast, even a perfect causal model of weather effect is of limited use.

One can therefore think of changes in the load as being subject to two basic kinds of influence:

a) Regular patterns which change only slowly over time, and are therefore highly predictable.

b) Random patterns such as weather, strikes and the business cycle which are difficult to forecast and therefore give rise to most of the errors in the forecast.

Forecasting is essentially an attempt to:

1) identify the regular patterns;

2) measure the amplitude of the irregular patterns (which also have irregular frequencies, although these may be classified as generally high or low).

This gives rise to a forecast and an estimate of forecast error.

9.2.2 Load Forecasting in Ontario Hydro

The process of growth described in section 9.1 consists of inferences drawn from observation and study of growth in the demand for electricity in Ontario and elsewhere over many years. The description is an effort to relate the growth process in a general way to the wider economy and the society in which it operates. Such a description has explanatory merits, but it lacks the precise quantitative relationships which are required for it to have merit for prediction. For one thing, a forecasting approach based upon explanatory social and economic variables requires not only a reliable forecast of those variables, but a means of translating them precisely into electrical demand in Ontario. Means of doing so which yield better results than existing methods are not presently available. Moreover, the requirements call for the geographical distribution of electrical load in Ontario as well as the time path of system demands. For these reasons, the forecasting approach in Ontario Hydro consists essentially of forecasts of

individual customers' peak loads. The procedure is as follows:

i) When a new forecast is required (normally once a year), notification is sent by letter to the Regional Offices.

ii) The Load Forecasting Unit prepares a set of two computer generated forecasts for each municipal and rural area wholesale customer. These are generated by a computerized forecasting model described in (4).

iii) Regional personnel _must_ reject one of the computer forecasts, but _may_ reject both and prepare their own. The computer forecasts are intended as a guide only. They are particularly helpful in assessing normal seasonal variability in load.

iv) For direct industrial customers, computer projections are not provided, because the model is not appropriate. Regional personnel compile forecasts for these customers after detailed consultation with them.

v) When the regional forecasts have been completed, they are sent to the Load Forecasting Unit for assessment and compilation into system totals.

While the regional forecasts are being prepared in the field, the Load Forecasting Unit is also preparing a series of forecasts. These consist principally of two lines of approach:

a) forecasts of regional and class totals using the computer model, but with a number of projections for each series;

b) forecasts of system totals using explanatory economic variables.

When the regional forecasts are received, they are placed in the computer data bank and the totals are compared with those described in a) and b) above. Where discrepancies can be traced to individual forecasts, these are discussed with regional personnel. When reasons for the discrepancy are identified, they are incorporated in notes to the

report in order to assist users, and to point to major uncertainties where these exist.

Where discrepancies still remain, the forecast may be modified by the application of judgement by the Load Forecasting Unit. In quantitative terms, this takes the form of "unallocated load" which is load included in the forecast, but not assigned to any particular customer, although it is usually assigned to a particular class within a particular region. Unallocated load may be either positive or negative.

Positive unallocated load is used to compensate for the fact that the load forecasting process basically consists of forecasts of existing customers, and therefore does not take into account the probability that new customers may be added. This is particularly relevant to mining developments where the company that will do the mining may not yet exist. Positive unallocated load may also be used in times of economic recession in an effort to offset excessive emphasis on the recent, gloomy past.

Negative unallocated load is incorporated in the forecast where the judgement of the Load Forecasting Unit is that regional forecast totals may not be realized. Sometimes this arises due to excessive optimism attending the timing and magnitude of a projected growth in load, such as a new subdivision or an industrial expansion. Negative unallocated load may also be applied to the forecast where it appears to be at odds with current economic prospects in the judgement of the Load Forecasting Unit.

Unallocated load is therefore a quantitative measure of the judgement of the Load Forecasting Unit as applied to the most likely value of the forecast. Further detail on the method of estimating unallocated load is contained on page 13 of section 2 of volume 2.(1)

Judgement also plays a role in assessing the uncertainties associated with the forecast, and their attendant probabilities. Together they make up a probability distribution of forecast error which can be used in assessing the risks associated with any plan or decision.

The load forecasting system in Ontario Hydro thus combines the use of a mathematical model with the

application of the detailed knowledge of individual customers which is available from Ontario Hydro personnel in the field, and within utilities, areas, and direct customers served by Ontario Hydro. The reasons for adopting this detailed approach over that of deduction from global social and economic causes are twofold:

i) It appears to produce aggregate or system forecasts of greater accuracy than any deductive mathematical model which has been applied to date.

ii) It produces the geographical detail of customers' peak demands which is needed for system planning purposes, while a model using explanatory social or economic variables would tend to yield annual energy, perhaps by end-use category, which would then require disaggregation into monthly energy by geographical unit and translation into peak load.

The fact that this approach produces forecasts with smaller errors than other methods is not altogether surprising when one considers that it brings to bear more relevant information than is the case with even the largest econometric model. As the time horizon extends into the future, the available knowledge peters out, and consequently greater emphasis tends to be placed on mathematical techniques.

The system suffers from the disadvantage that it is hard to persuade the public that changes in explanatory economic and social variables such as birth and immigration rates, incomes, changing consumer preferences and the like are captured by the approach, but they are not isolated by it. For example, increased load by virtue of concern for the environment may show up in the forecast as a new sewage plant in a municipality and some additional pumps in a paper mill, but this load may or may not be specifically identified by its cause. Similarly, declining birth rates will show up in altered plans for housing types and quantity, but once again the cause will not be identified although it may be speculated upon after considering trends in the aggregate forecast. Moreover, the classification system into customers' loads is primarily geographical and administrative rather than by end-

use classification, except perhaps for the direct industrial load. In any event, even if end-use classifications were available, they would refer to energy, most likely on an annual basis, and it would be extremely difficult to convert such predictions to peak load on a monthly basis with the required geographical distribution.

Consequently, the forecasting process as it exists differs from the process of growth as it has been described. Nevertheless, some understanding of the process of growth provides a useful background against which to assess the results of the forecasting process in an attempt to answer the vital final question: are the results reasonable?

No forecast carries with it any guarantee of accuracy, and the occasional forecast can be badly in error. In assessing these bad forecasts it is useful to have available for scrutiny a general statement on expectations at the time the forecast was made. A forecast is "bad" only if a better one could have been made with the information on hand at the time. Anyone can make a good forecast with the benefit of hindsight. Similarly, an assessment of the uncertainties associated with the forecast gives its users some appreciation of the risks that they run, and often provides an insight into the cause of subsequent forecast error.

9.3 PROSPECTS FOR ELECTRICITY DEMANDS IN THE LONGER TERM

Electric energy is of no use by itself; it is used to drive a wide variety of appliances. Consequently its end uses encompass a wide spectrum of activities classified in a socioeconomic sense. Since, for most practical purposes, electricity cannot be stored but must be generated as it is required, the timing of its consumption determines to a great degree how much capacity and the type required. In economic terms, the demand for electric energy is a derived demand. It is consumed in conjunction with some device which is generally a durable capital good. Similarly, its production involves capital goods, and since the energy is not stored, inventory must be carried in the form of capital goods capable of producing and of consuming it on demand, at the place it is wanted.

The information required for planning the system is therefore primarily a knowledge of maximum rates of energy consumption in considerable geographical detail in order to provide answers to the capacity questions: when?, where?, and how much? For coal ordering purposes, total energy demand is important, but even so, finer chronological detail than annual energy is needed, given that coal shipments must be made during the navigation season. Design and operation of the system requires even finer chronological detail and results in studies of hourly demands.[5] The load forecasting system at Ontario Hydro is primarily designed to answer the three foregoing questions.

As mentioned previously, reference is made to global explanatory variables when assessing the system totals derived from the output of the load forecasting system.

For longer range forecasts, such as the period 1983-1995 which is under consideration here, the annual totals of energy and peak demand are the quantities of primary interest.

The basic data from 1935 to 1975 together with the 1976 Load Forecast data is shown on Table 1 which is extracted from Load Forecast No. 760209.[6]

The average rate of growth in primary energy demand (measured by a fitted least squares trend line corrected for autocorrelation) in the period 1926-75 has been 7.3% per year. The growth has been from 2.4 GWH in 1923 to 84.2 GWH in 1975.[7]

Consumption of electric energy is widely believed to be associated with Gross National Expenditure. Such a relationship for Ontario relates GNE in constant (1971) dollar terms as follows:

$$\text{Log(Energy(Av.MW)} = -.4613 + .6087(\text{Log GNE}) + .01834(\text{Yr}-1900)$$

The relationship has a standard error of 1% and is estimated to be autocorrelated (.563). Its coefficient of multiple correlation is .9965.

The foregoing relationship can be used with forecasts of Gross National Expenditure.

Figure 1 contains the historical Gross National Expenditure for Canada in 1971 constant dollars 1926-1975. Also shown in Figure 1 are projections:

a) based on ordinary least squares allowing for autoregression. The equation is: $E(\text{Log GNE})=3.4981+.02061(\text{Yr}-1900)$

b) based on a logistic curve whose equation is $1/\text{GNE}=161.86+8855.8(.9514)^x$ where x is the number of years from 1926.

The logistic or Pearl-Reed projection is an empirical relationship developed to study the saturation of populations (such as bacteria in a quart of milk). The growth rate declines until a ceiling (in this case $618 billion of GNE) is approached.

Also shown on Figure 1 are confidence limits to the trend projection mentioned in a). These have been chosen such that there is a risk of just over 40% that the actual event will fall outside of one or other of the limits. That is to say there is one chance in 5 that it will be above the upper limit.

In Figure 2, the actual year to year percentage change in GNE is shown in relation to its mean growth (4.86%). Also shown is the growth implied by the logistic curve. It will be noted from Figure 1 that the logistic projection of GNE lies very close to the lower limit chosen.

Application of these four projections to energy demand is compared to the 1976 Forecast to 1985 in Table 2. The projections have been extended to 1995, to give some idea of the range of possible outcomes.

As indicated previously, the confidence limits shown embrace a probability of about 60%. The range which they cover amounts to 1.6 standard deviations.

As the forecast is extended farther into the future, the range of uncertainty increases, not only in absolute terms, but as a percentage of the demand. This reflects increasing uncertainty into the future for such reasons as:

1) some influences operate slowly but cumulatively, and therefore have little influence in the short run, but a great deal of weight in the longer

run. For example the 1977 Ontario population can be forecast quite accurately, while the 1995 population is a matter of considerable conjecture.

2) A projection based on an assumption of a steady underlying rate of growth is undoubtedly wrong for one of two reasons:

   a) There can be an error in the estimated rate of growth, or

   b) the underlying growth may not be steady, but may be more closely approximated by a logistic or some other saturation curve. Alternatively, it is quite possible that electric energy demand in Ontario may experience higher sustained growth rates than have been observed in the past. This could happen if difficulties are encountered in the supply of oil and/or gas which are beyond the capability to harness required amounts of solar energy.

   For short periods, various estimates do not diverge much, but like the rays from a light source, they tend to diverge as the distance increases.

3) The amplitude of low frequency random variations may have been underestimated. For example, business cycles in the post war period have been less severe. Is there any reason to believe that a depression of a larger magnitude than that of the 1930's is unlikely? Or for that matter an unprecedented boom might occur were the rich nations of the world to undertake a massive program to rid the world of poverty on a scale previously associated only with warfare.

4) Changes in technology and circumstances leading to changes in prices are extremely difficult to predict, even though they have tended to be the rule rather than the exception.

As can be seen from Table 2, the 1976 forecast, and its extension tend to be at the lower end of the ranges shown, and in fact appears to be consistent with the projection based on the assumption that

Gross National Expenditure may follow a logistic path towards a ceiling of $617.8 billion at 1971 prices.

While there appears to be ample justification for the current forecast to be at its present level compared with the indications from past trends and relationships, there can be no assurance that the actual outcome will not be higher than the forecast. It is, for example, suspicious that the forecast was made during a period of economic recession. Forecasters can be as susceptible to a prevailing atmosphere of pessimism as anyone else, and the record tends to bear this out.

In this connection, it is perhaps of interest to take a retrospective look at a previous long range forecast. This one was presented to the Gordon Committee on the Organization of Government in Ontario by Mr. James S. Duncan on November 18, 1958. The forecast was for all systems peak demand, and its track is shown in Table 3. This forecast was made early in a recession. It was too high generally to 1966, too low until 1974, when it came into line (during the present recession).

The pattern of error in Table 3 is instructive. A succession of errors in one direction is followed by another succession in the opposite direction. This reflects low frequency random variation associated with the business cycle. Because it is random, it is basically unpredictable. However, there is an almost irresistable temptation to confuse low frequency random variation with the emergence of some new and significant trend. Among other things, the existence of this phenomenon (which does not appear to be widely recognized) accounts for most load forecast error. The downward phase of the low frequency variation at the present time raises serious questions about the present forecast - giving it plenty of scope for error. If this frailty is recognized, it can be planned for.

Table 1

LOAD FORECAST REPORT NO.760209
ONTARIO PRIMARY DEMANDS - TOTAL SYSTEMS

Dec.	Peak Mw	Annual Energy Mwh	Annual Energy Av. Mw	Load Factor %
1935	907.1	4,661,343.7	532.1	58.7
1936	992.1	5,114,693.9	582.3	58.7
1937	1,068.0	5,806,700.2	662.9	62.1
1938	1,123.7	5,753,253.4	656.8	58.4
1939	1,272.0	6,346,688.8	724.5	57.0
1940	1,345.4	7,616,829.0	867.1	64.5
1941	1,543.2	8,755,874.6	999.6	64.8
1942	1,559.2	9,671,627.1	1,104.1	70.8
1943	1,631.3	9,813,413.8	1,120.3	68.7
1944	1,708.5	9,862,565.7	1,122.8	65.7
1945	1,771.3	10,334,944.6	1,179.8	66.6
1946	2,036.1	10,575,379.3	1,207.2	59.3
1947	2,262.2	12,495,821.2	1,426.5	63.1
1948	2,393.0	12,991,064.4	1,478.9	61.8
1949	2,443.7	13,511,035.9	1,542.4	63.1
1950	2,753.1	15,175,583.7	1,732.4	62.9
1951	3,063.1	17,241,303.9	1,968.1	64.3
1952	3,247.7	18,401,371.7	2,094.8	64.5
1953	3,442.8	19,590,139.1	2,236.3	65.0
1954	3,655.7	20,471,343.9	2,336.8	63.9
1955	4,183.2	22,877,271.2	2,611.4	62.4
1956	4,468.5	25,135,134.1	2,861.4	64.0
1957	4,737.6	27,002,762.0	3,082.4	65.1
1958	5,093.1	27,979,394.9	3,193.8	62.7
1959	5,510.6	31,143,172.8	3,555.0	64.5
1960	5,699.8	32,319,968.2	3,679.4	64.6
1961	5,902.9	33,569,282.4	3,831.9	64.9
1962	6,247.0	35,488,962.2	4,051.1	64.9
1963	6,750.6	37,288,964.1	4,256.5	63.1
1964	7,163.9	40,305,468.3	4,588.5	64.1
1965	7,818.4	43,511,759.8	4,967.1	63.5
1966	8,565.6	48,054,384.4	5,485.7	64.0
1967	8,963.8	51,355,505.0	5,862.5	65.4
1968	9,994.4	55,788,374.7	6,351.1	63.5
1969	10,555.4	59,424,443.4	6,783.6	64.3
1970	11,288.7	64,287,605.7	7,338.8	64.8
1971	11,534.5	68,132,582.0	7,777.7	67.4
1972	12,738.8	73,495,941.4	8,367.2	65.7
1973	13,605.4	78,162,478.1	8,922.6	65.6
1974	13,538.1	82,695,005.7	9,440.1	69.7
1975	14,512.5	84,220,853.4	9,614.2	66.2
LOAD FORECAST ESTIMATE NO.760209				
1976	15,601.0	90,504,187.0	10,303.3	66.0
1977	16,945.0	98,243,400.0	11,215.0	66.2
1978	18,302.0	106,463,784.0	12,153.4	66.4
1979	19,539.0	114,089,364.0	13,023.9	66.6
1980	20,856.0	122,060,707.0	13,895.8	66.6
1981	22,220.0	130,127,172.0	14,854.7	66.8
1982	23,709.0	138,842,496.0	15,849.6	66.8
1983	25,302.0	148,150,872.0	16,912.2	66.8
1984	27,001.0	158,509,037.0	18,045.2	66.8
1985	28,816.0	168,679,056.0	19,255.6	66.8

Table 2

All Systems Primary Energy Demand in Av. Mw.

Based on Various Projections* of GNE

	1976 Forecast	Upper Limit**	Trend	Lower Limit**	Logistic
1976	10,303	10,795	10,573	10,348	10,433
1977	11,215	11,856	11,512	11,162	11,297
1978	12,153	12,922	12,464	11,995	12,162
1979	13,024	14,023	13,450	12,862	13,050
1980	13,896	15,179	14,487	13,773	13,975
1981	14,855	16,404	15,586	14,740	14,948
1982	15,850	17,710	16,758	15,769	15,975
1983	16,912	19,108	18,010	16,868	17,063
1984	18,045	20,605	19,351	18,043	18,217
1985	19,256	22,212	20,788	19,299	19,441
1986	20,546***	23,937	22,230	20,644	20,741
1987	21,923	25,791	23,984	22,085	22,120
1988	23,391	27,783	25,758	23,626	23,583
1989	24,959	29,924	27,663	25,277	25,135
1990	26,631	32,225	29,708	27,045	26,781
1991	28,415	34,700	31,903	28,938	28,525
1992	30,319	37,361	34,259	30,973	30,373
1993	32,350	40,222	36,788	33,135	32,329
1994	34,518	43,299	39,504	35,459	34,400
1995	36,830	46,607	42,419	37,947	36,591

*Using the relationship Log(E)=.4613+6087 Log(GNE)+ 1834 (Yr-1900)

**Limits are conditional expectations of (GNE) which are ± 0.8 standard errors from the expected value.

***Projections

Table 3

Forecast Presented to the Committee on the Organization of Government in Ontario on November 18, 1958

All Systems Peak (MW)

December	F/D	Actual	% Error*
1958	5,099	5,093	.12
1959	5,495	5,511	- .28
1960	5,890	5,700	3.22
1961	6,203	5,903	4.84
1962	6,583	6,247	5.10
1963	6,988	6,751	3.40
1964	7,420	7,164	3.45
1965	7,882	7,818	.80
1966	8,370	8,566	-2.34
1967	8,888	8,964	- .85
1968	9,438	9,994	-5.89
1969	10,023	10,555	-5.31
1970	10,644	11,289	-6.06
1971	11,303	11,534	-2.05
1972	12,004	12,739	-6.12
1973	12,749	13,605	-6.72
1974	13,539	13,538	0.00
1975	14,379	14,512	.93
1976	15,272		
1977	16,220		
1978	17,226		
1979	18,296		
1980	19,433		

*100 x (Forecast - Actual)/Forecast

Line Number

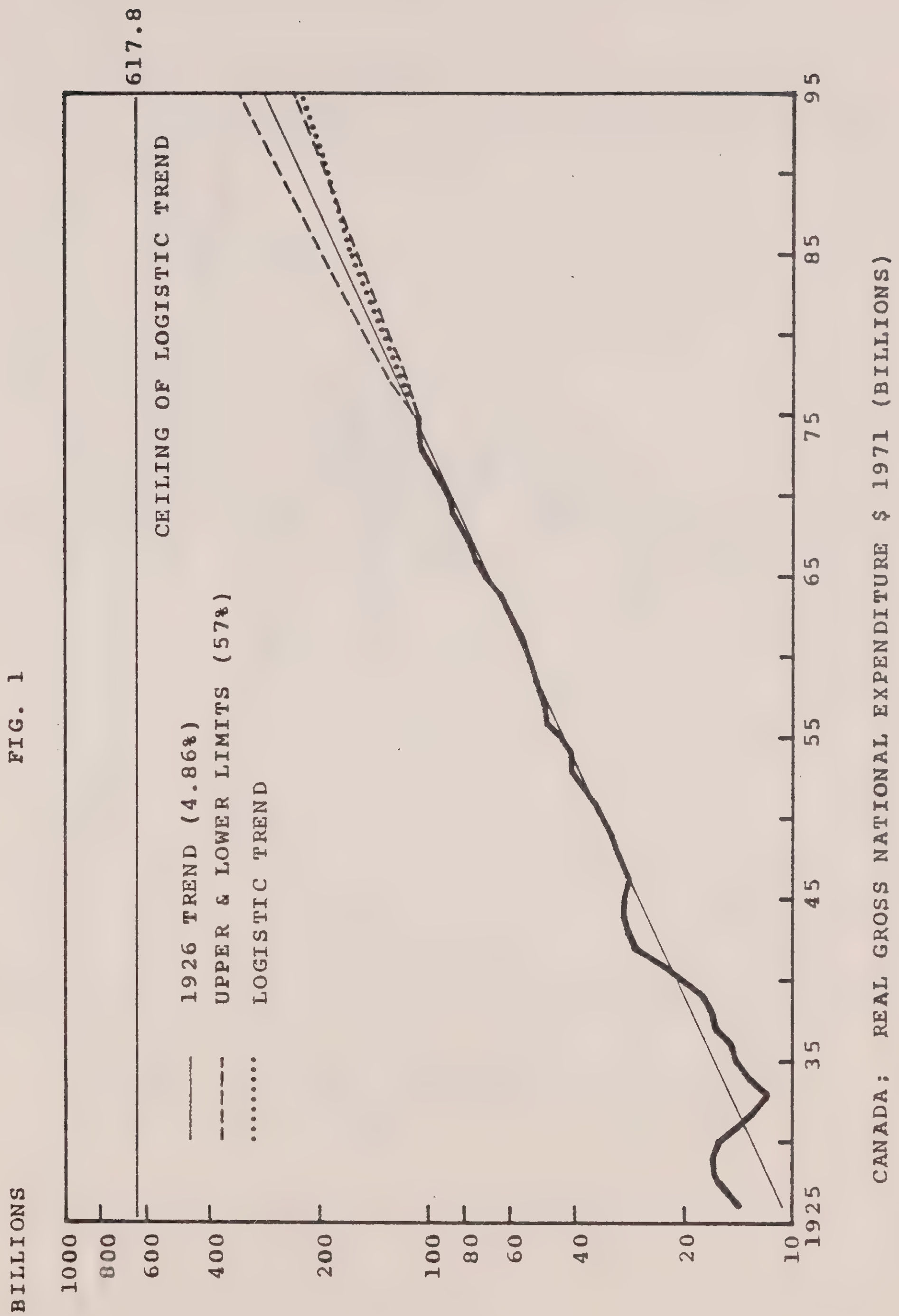
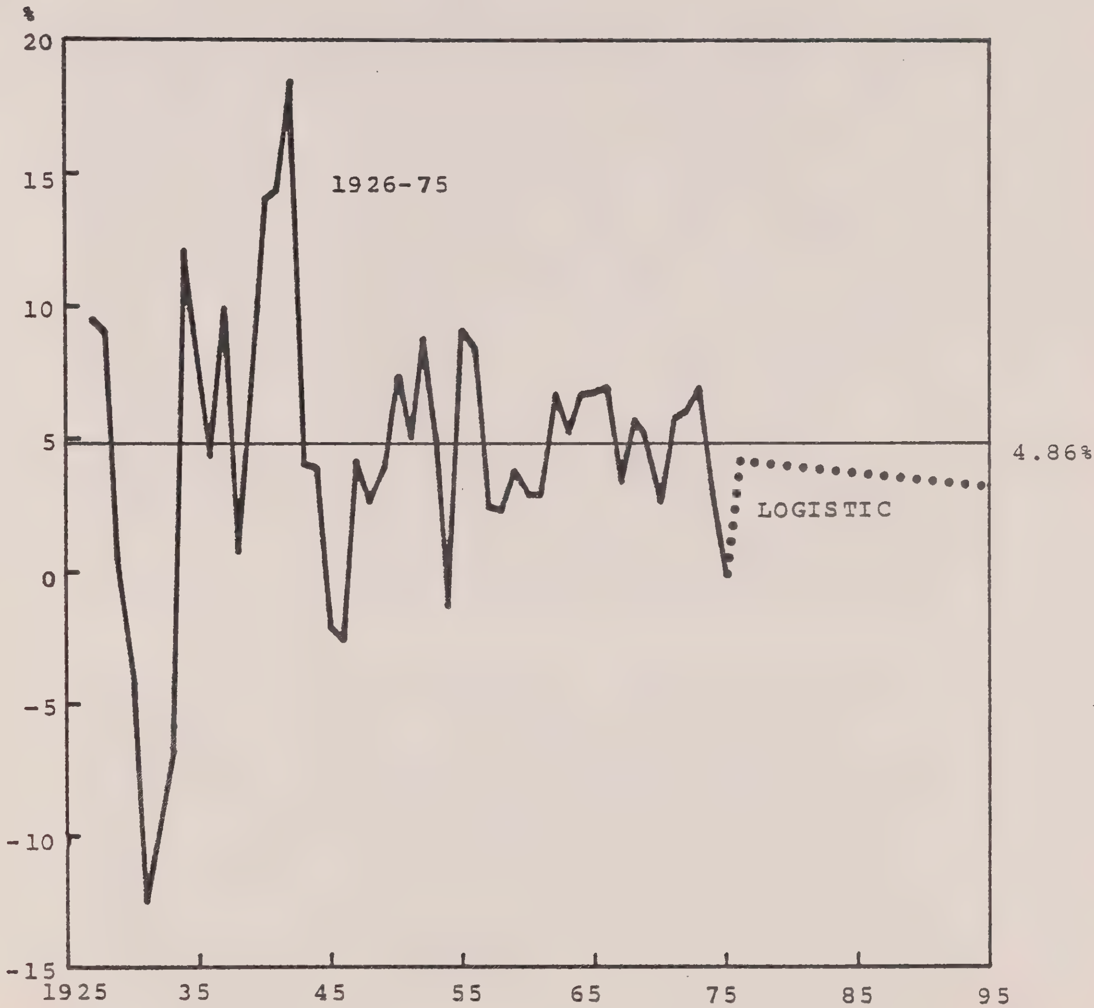


FIG. 1

FIG. 2



CANADA: REAL GNE, YEARLY CHANGE IN PERCENT

9.4 EFFECT OF OTHER FACTORS

9.4.1 Price

The history of the demand for electric energy in Ontario is one of falling prices in real terms. It is also true that the prices of utilization equipment, notably appliances, have also been falling in real terms. These factors, other things being equal, would tend to stimulate the demand for electricity. However, the prices of alternative fuels have also been falling until recently. The decline in the price of gas after 1955 has been particularly dramatic. With the price of all major forms of energy falling in real terms until the early 1970's, there has undoubtedly been a shift in Ontario towards more intensive use of all forms of energy. About half of the growth in total energy demand in Ontario (excluding transportation use) can be explained by changes in Real GNE, which can be considered as capturing income and population changes. It seems reasonable to assume that the other half may be accounted for by changes in prices, technologies and attitudes towards the use of energy. Thus as the real price of all forms of energy rises, it seems likely that the demand for energy will grow less rapidly for given changes in GNE.

The degree of these changes in real price not only of electricity, but also of other fuels is not known with any precision. Increases in the price of electricity will tend to reduce the demand for it, other things being constant. However, increases in the price of substitute fuels will tend to shift energy demand towards electricity in the absence of other changes. Consequently, the effects of price increases in all forms of energy are offsetting, subject to their combined depressing effect on the demand for energy generally.

During the span covered by this forecast, it seems likely that:

- oil prices in Canada will move to the international level;

- gas prices will move to heating content parity with oil.

If such price movements offset the increased prices of electricity, then it would appear that the forecast may be too low (apart from any total impact on energy demand in total). However, increasing energy prices tend to have an indirect effect on incomes, in that customers seem likely to spend a higher proportion of their budget on energy and less on other things (such as appliances) in response to an increase in energy prices.

The timing of price changes in the various fuels may prove to be crucial in that a possibility exists for large, but transient responses to occur. This gives rise to considerable uncertainty in the forecast.

9.4.2 Availability and Conservation

While the 1976 load forecast was being prepared, Ontario Hydro's system expansion plans were deferred to a degree that the outlook for the reliability of electric power supply after 1979 will change radically from past standards if the 1976 forecast demands materialize. A deterioration in the quality of the service may reduce the demand for it in much the same way as an increase in its price. At the same time, the availability outlook for alternative fuels seems to be more promising than in 1975; thus the risk of a massive shift to electric heating for example, may have diminished.

Exhortation to the public to save all forms of energy has accelerated in the past year. The Federal Department of Energy, Mines, and Resources is currently sponsoring an advertising campaign aimed in part at reducing the demand for electric energy. However, the campaign to date has dealt principally with commercial consumption at night.

9.4.3 Weather Effect on Winter Peak

For a number of years, the East System winter peak demand occurred in December, usually in the full working week before Christmas unless extremely cold weather was encountered earlier in the month. The January peak occurred early in the month. Weather corrected demands used to come to a sharp peak in the week before Christmas, probably owing to extensive decorative lighting that was common before 1973. In the new year, they would drop off rapidly. For a number of past years, it has been evident that

January peak demands are growing more rapidly than December, probably due to electric heating, and forecasts for a number of years have reflected this.

With the former sharp weather corrected seasonal pattern peaking in December, the period during which cold weather could significantly result in an increase in the winter peak load was very short. Because the period of exposure was so short the forecast December and January peaks were assumed to occur under normal temperature conditions.

More recently, and particularly since 1973, with decorative lighting load having declined, the weather corrected pattern of load has become quite flat from early in December until early in February. This means that the winter peak load now seems likely to occur on the coldest working day between the first week in December and the first week in February. This is to say, the period of exposure has lengthened dramatically.

The weather effect to be expected in a "normal cold weather spell" is currently estimated at 1.6% of the weather corrected peak demand. However it has been observed that the system is becoming more temperature sensitive, and it is expected that the "normal weather effect" may increase from 1.6% to over 2%.

It is interesting to note that the winter peak in 1975/6 occurred on February 2; the second highest peak was on January 22. On both days temperatures were more than 35°F below normal.

9.5 UNCERTAINTIES AND RISKS

It should be noted that the reduction in 1976 of the East System forecast is the second significant reduction in two years, and it continues a pattern which except for the forecasts of 1973-4, has been in evidence since 1969.

This is illustrated by the following pattern of forecasts for the load in 1984:

Forecasts Made in	Forecast for 1984	% Change from Previous Year's Forecast
1968	27,792	+4.23
1969	28,537	+2.68
1970	28,444	- .32
1971	27,977	-1.64
1972	27,429	-1.96
1973	27,560	+ .47
1974	28,264	+2.55
1975	26,899	-4.83
1976	25,631	-4.72

The 1926-74 trend value for 1984 was 26,761. Incorporating the 1975 data dropped the value to 26,373. The 1975 forecast value was above the trend value and drifting towards it. The 1976 value is below trend and, like last year's forecast is growing less rapidly than trend.

The planning process at Ontario Hydro can accommodate itself to orderly changes in forecasts, but it tends to be severely disrupted by oscillating forecasts. Even though the change in the 1974 forecast was small, its reversal in the 1975 forecast caused severe disruption to the planning process.

Lowering any forecast increases the risk of upside error, just as increasing it increases the risk of downside error. A change in the outlook such as occurred between the 1974 and 1975 forecasts cannot help but be conditioned by what has happened in the recent past. The fact that forecasts have tended to be high for the past few years strongly suggests the need for downward revision, even though this experience may be totally irrelevant to a year as far in the future as 1984, as shown in 9.3 and in Table 2.

In fact, the record of the past shows that forecasts made in periods of recession have invariably proven to be too low, and forecasts made in periods of boom have invariably proven to be too high, as shown in Table 4, taken from Load Forecast No. 760209.(6)

Table 4

EAST SYSTEM FORECAST ERROR (%)*

Year of Forecast	Years after Forecast									
	1	2	3	4	5	6	7	8	9	10
1950	-5.6	-11.1	-14.7	-16.6	-18.1	-25.4				
1951	1.1	0.1	-.4	-1.5	-9.3					
1952	2.2	5.0	6.1	-2.0	-4.1					
1953	2.3	4.0	-2.5	-3.9	-4.1	-6.6				
1954	-0.4	-5.2	-6.0	-5.2	-7.4					
1955	-3.0	-2.5	-1.5	-3.2	-6.7	-5.3				
1956	1.6	5.7	4.8	2.0	3.7	5.2				
1957	2.8	1.5	-0.9	3.4	6.3	6.6	6.2	6.7		
1958	-0.9	-2.2	2.1	4.1	3.8	1.4	1.4	-1.8	-4.7	-3.4
1959	0.1	2.8	6.1	6.4	4.1	4.5	0.6	-2.9	-2.0	-7.4
1960	2.6	5.3	6.0	3.2	3.6	0.4	-2.9	-1.6	-6.6	-6.2
1961	1.9	3.2	0.8	0.6	-3.0	-5.4	-3.6	-8.3	-7.8	-8.5
1962	1.0	-1.9	-1.6	-4.8	-7.5	-6.6	-10.6	-10.1	-10.7	-7.1
1963	-2.7	-2.3	-6.0	-8.6	-7.1	-11.6	-10.8	-11.3	-7.5	-10.7
1964	-1.6	-4.4	-6.5	-5.3	-9.4	-8.7	-9.4	-6.4	-4.4	-5.1
1965	-1.2	-3.7	-1.5	-5.9	-5.2	-5.8	-1.7	-5.1	-5.6	0.0
1966	-1.0	0.2	-5.9	-4.2	-4.8	-0.6	-4.0	-4.4	1.7	0.1
1967	1.2	-3.1	-2.0	-2.2	2.4	-0.8	-1.0	5.5	4.2	
1968	-0.3	1.7	1.7	7.0	3.2	2.7	9.5	8.2		
1969	0.9	1.9	7.0	5.2	5.6	13.0	11.3			
1970	1.0	6.7	5.7	5.5	12.0	10.9				
1971	6.2	3.4	3.6	10.0	9.0					
1972	1.9	2.0	8.6	7.2						
1973	0.4	7.9	7.5							
1974	6.3	6.3								
1975	1.1									

*Difference between forecast made 1 to 10 years prior to year indicated divided by actual. A negative sign indicates forecast is too low.

9.6 TASTE AND LIFESTYLE

Socioeconomic and environmental variables such as prices, incomes, population, weather and government regulations play an important role in determining the demand for any commodity or service. The variables do not, however, define it completely, except within a given framework of attitudes and ambitions which, when translated into action can be regarded as taste and lifestyle. Unlike prices and incomes, the latter are not easily quantifiable, and therefore tend to be neglected in analysis even though they may be mentioned.

Nevertheless, the past half century or so has witnessed far reaching changes in Ontario tastes, lifestyles, and probably attitudes. Whether the ambitions or goals of Ontario society have changed much is more open to question, and it is an important question.

The changes in taste, attitudes, and lifestyles have occurred largely as a result of changes in available technology and increases in real incomes. The advent of the internal combustion engine and of electricity radically increased farm productivity and productivity in the production of goods, and thus provided a basis, not only for a drastic increase in real income per capita, but for such related developments as:

a) increased urbanization;

b) rapid growth in the service sectors of the economy;

c) the disappearance of servants;

d) increased leisure;

e) a much wider range of choice for individuals;

f) increased security including old age pensions and unemployment insurance.

The internal combustion engine and the advent of electricity both had the effect of dramatically reducing the cost of physical work in the Ontario economy. For example, one horsepower operating for one hour can do the work of lifting a weight of 99

short tons to a height of 10 feet. The same amount of work can be done by three quarters of a kilowatt-hour at a cost in the order of two cents or so plus the cost of the associated kilowatt of capacity for 45 minutes. It is also the same amount of work required to lift 3,600 boxes of apples (43 lbs.) a distance of 13 feet. At a minimum hourly wage of $2.75, a labourer would have to lift one box per second to get the job done in an hour, and the cost of the energy to do the work would be over 100 times as much.

This ability to do work at a fraction of its previous cost has enabled Canadians to feed themselves, (and a good part of the rest of the world) by devoting something approaching one twentieth of their human resources to the task. Moreover, the bulk of the productivity gains has accrued to society at large rather than to the farmers and goods producers.

One effect of increased affluence has been improved social security. In less affluent and more traditional societies, old age security is provided by one's children. Lack of worry about old age, together with new and effective means of birth control have led to a dramatic decline in birth rates. In the shorter term, this means an increase in the ratio of the working population to the dependents it must support. In the longer term, however, this ratio will tend to decrease, and the working population will have more dependents to support. Moreover, these dependents will be old rather than young, and therefore the expenditure on dependents will tend to be consumption-related rather than investment. At the same time the burden on the working population increases, its political power will tend to decrease as it comes to be outvoted by the older population. It is possible that confidence in the security of one's old age will erode and this may lead either to changed birth rates or to increased immigration.

The prospects for a continuing increase in productivity at the rates which have prevailed for most of this century are also open to question, since those sectors of the economy in which these gains have been made are becoming less important in the weighting of the economy.

To all of this must be added the probability that energy prices in real terms have probably passed their minimum point. There is growing acceptance of the thesis that oil and gas production in the world will have peaked by the time the century draws to a close.[8] The perceptible alternatives are increased reliance on coal and uranium. Further harnessing of solar energy for individual heating applications may offer an opportunity for reducing the reliance on other energy forms for those applications.

The present point in time is not the most advantageous from which to take a long view into the future. This is so largely because the world is presently adjusting to the quadrupling of oil prices in the fall of 1973. The repercussions of this event are still resounding through prices of all forms of energy. To a great extent, the Canadian economy has been cushioned from these shocks by its own limited stockpile of low cost energy reserves. It would appear, however, that whatever advantage Canada may have had in this respect has been eroded by inflation with a resulting deterioration in the balance of payments and international competitiveness.

It has been suggested here that tastes and lifestyles have changed in Ontario in this century as a result of improved technology and cheap energy leading to affluence through increased productivity.

Some of these changes have led to changes in the timing of energy consumption (late shopping hours, staggered working hours, television viewing). Most have led to increased energy consumption. For example snowmobiles have led in increased automobile travel to summer cottages which are now used all year, and many of which are electrically heated. To this extent, they can be explained largely by changes in prices and incomes.

While tastes, lifestyles and even attitudes have been mentioned, nothing has been said about ambitions or the goals of Ontario society. This is largely because it can be argued that there has probably been little change in these ambitions. To the extent that it is possible to describe them at all, it may be argued that the goals of Ontario society have generally been concerned with increasing the ability to satisfy material wants. This definition sounds trite because until recently it has been accepted

almost without question in the western world. It is also probably fair to say that events in Ontario since World War II have carried its society far closer to the fulfillment of these goals than many people would have believed possible. "Progress" may in fact have overtaken expectations.

One result of this is growing disillusionment with "progress", and greater consciousness of its growing social costs - to the environment for example.

With the publication of "The Limits to Growth"(9) a debate has been opened which has been regarded as suggesting alternative goals for society. Hitherto, the fulfillment of existing ambitions has relied upon increasing material power over the environment. Until recently, little attention has been paid to the exhortations of Malthus(10) to practice restraint. This view defines the good life as creating a gap between desires and the means to satisfy them.

The western world has chosen to create this gap by increasing the means to satisfy wants at a faster rate than the wants themselves increase. One has only to look at successive definitions of the "necessities" of life to see what has been happening. For example one definition of a "necessity" is a goal or service for which no cheaper substitute exists.

The Oriental approach is different, and may be relevant to the future.(11) Here the approach is to create the gap between wants and the means of satisfying them by suppressing the wants themselves as opposed to increasing the power to satisfy them.

If this approach to the fulfillment of social objectives gains acceptance in Ontario, then the prospects for the future demand for electricity will be altered radically - in keeping with such a radical change in approach.

That such a change in approach may take place, (with its associated changes in attitudes, tastes and lifestyles), cannot be dismissed as an impossibility. Within the framework of modern, western welfare economics, it can be argued that if external costs (to the environment for example) rise more rapidly than developing technology can offset them, then one means of maximizing welfare is to limit demands. The alternatives for limiting demands are either

voluntary (as in development of the conservation ethic) or coercive.

The prospects are that the former approach will be reinforced by changes in real prices and incomes. While coercive measures offer quick results in the short-term, they probably frustrate the achievement of the underlying objectives. They are nevertheless a constant and perhaps irresistible alternative.

It is not possible to estimate whether Ontario society is on the threshold of an epochal change in approach. Nor is it possible to estimate the length of time for which the development of new technology and new resources can postpone the day. It may be that developing technology will create the basis for a totally different society in the future in which the continued use of the factory system for office workers will be technically if not socially unnecessary.(12) However, the time has come to consider the possibility, and how it should be dealt with.

The case against seeking salvation by limiting desire has been put by Herman Kahn of the Hudson Institute.(13)

9.7 ONTARIO HYDRO LOAD PLAN

9.7.1 General

As already mentioned in Section 9.4.2, while the 1976 load forecast was in the process of preparation, a cutback in the system expansion program was decided upon. The decision was imposed by restrictions on available capital and it was recognized that capital constraints would reduce system reliability, perhaps drastically. The result is that the current system expansion plan is not based upon the Load Forecast as in other years. Since the remedy of additional capacity is foreclosed, the Board of Ontario Hydro adopted on March 8, 1976 a policy of conservation objectives or targets for the short term to attempt to bring the load growth within the capacity limit imposed by the capital constraints. Estimates of the potential reduction in energy demand achievable through change in habit and application of known technology were approved as a tentative target and deducted from the 1976 Load Forecast.

9.7.2 Ontario Hydro Conservation Targets

Estimates of the quantities of demand reduction through conservation measures were based on an evaluation of the major end-uses of electricity in each market sector for 1974, i.e. residential, commercial and industrial, as shown in Table 6.4.1 in the memorandum "Energy Utilization and the Role of Electricity". The 1974 kilowatthour savings (about 9%) were projected to 1982, as shown in Table 6.4.2 in that document. A proportional amount of additional conservation effect was assumed for the incremental growth over this period.

Since the savings were estimated in terms of kilowatthours they had to be translated to kilowatt demand coincident with system peak periods. This was done through knowledge of the characteristics of the load components in respect to both load shape change in response to conservation and the coincident relationship with system peak.

In the short-run it was judged that most of the kilowatthour savings by residential and commercial customers would occur in off-peak hours. However, in larger industry it is more likely that savings would be effected over all hours more uniformly. This is because of both the method used to achieve the conservation and the incentive which exists in the current rate structure to control peak demand.

As a result of these considerations the demand reduction equivalent to the saving of 12.3 million megawatthours in 1982 is estimated to be 831 MW coincident with the December system peak. In order to arrive at preliminary figures for the period after 1982, and having in mind the uncertainty regarding the reduction that can be achieved by voluntary conservation, an assumption has been made that the conservation potential from the present base, plus that from incremental growth, will have been achieved in that year. In other words the load forecast for the East System for 1983 forward has been simply adjusted by subtracting 831 MW. The figures arrived at by this process, particularly those for the years 1983 and beyond, should not be interpreted as having greater significance than such a process would give them. That there may be further conservation potential in the incremental growth, or even some further potential in the present base demand, are

possibilities. The exercise is a brand new one and, as experience is gained in the next few years in relation to the conservation targets, that experience will be reflected by revisions to the present figures. In addition, programs for load management are being developed and will become an integral part of future Load Plans.

9.7.3 The 1976 Load Plan

When the estimates described in the previous section are subtracted from the Load Forecast and that forecast is further reduced by estimates of the amount by which the primary peak demand can be reduced by interruptible load cuts, the resulting figures may be referred to as the Load Plan for the East System. It is to be remembered that the figures represent target loads to be achieved through conservation efforts as opposed to the expected values contained in the Load Forecast. Insofar as the conservation targets are achieved, the effect of the program will be incorporated into future load forecasts, together with the effects of other changing variables.

No deductions have been applied to the West System demands for the effects of conservation or possible interruptible loads because of the different characteristics of the demand on that system.

Table 5 below sets out the Load Plan figures for each system for the years 1976-1995 inclusive.

TABLE 5

ONTARIO HYDRO LOAD PLAN (1976)
1976-1995

EAST SYSTEM		WEST SYSTEM	
Year	Firm Load (MW)	Winter of Year	Firm Load (MW)
1976	14,343	1976-77	828
1977	15,520	1977-78	922
1978	16,649	1978-79	1,010
1979	17,637	1979-80	1,066

1980	18,746	1980-81	1,134
1981	19,870	1981-82	1,195
1982	21,118	1982-83	1,257
1983	22,646	1983-84	1,323
1984	24,278	1984-85	1,391
1985	26,021	1985-86	1,464
1986	27,882	1986-87	1,540
1987	29,870	1987-88	1,620
1988	31,994	1988-89	1,704
1989	34,261	1989-90	1,793
1990	36,683	1990-91	1,886
1991	39,269	1991-92	1,984
1992	42,032	1992-93	2,087
1993	44,982	1993-94	2,196
1994	48,133	1994-95	2,310
1995	51,498	1995-96	2,430

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